membered that for the more distinctively thermo-electric metals *e* is much larger, and that it enters by its square. In any case it seems desirable that this complication should be borne in mind. The consequences which follow from recognised laws for laminated structures, however fine, must surely have some bearing upon the properties of alloys, although in this case the fineness is molecular.

RAYLEIGH.

NOTES.

THE De Morgan Memorial Medal has been awarded this year by the Council of the London Mathematical Society to Mr. Samuel Roberts, F.R.S. The medal is awarded every three years. Mr. Roberts was one of the earliest members of the Mathematical Society, and his first mathematical papers were contributed to the Society over fifty years ago. Since then he has continued, in the intervals of a busy professional career, to interest himself in the study of higher mathematics, and has published numerous papers, many of them of great value. The presentation of the medal will be made at the annual meeting of the Society in November next.

THE Council of the Society of Arts are prepared to award, under the terms of the Benjamin Shaw Trust, a gold medal, or a prize of £20. The medal, under the conditions laid down by the testator, is to be given "for any discovery, invention, or newly-devised method for obviating or materially diminishing any risk to life, limb, or health, incidental to any industrial occupation, and not previously capable of being so obviated or diminished by any known and practically available means." Intending competitors should send in descriptions of their inventions not later than December 31, 1896, to the Secretary of the Society of Arts, Adelphi, London, W.C.

ON Thursday last, a preliminary meeting was held in the Board Room of the Museums, William Brown Street, Liverpool, for the purpose of taking steps for the establishment in that city of a Zoological Garden on a scientific basis, and on the model of that in Regent's Park, London. On the motion of Prof. Herdman, seconded by Dr. Forbes, the following resolution was unanimously adopted :—"That in the opinion of this meeting it is desirable, in the interests of science and education in this city, to establish Zoological Gardens, containing a collection of living animals, and that those present form a Committee, with power to add to their number, for the purpose of advancing this object." The question of a site was considered, and it appeared that there was just now a favourable opportunity of securing land in a central position very suitable for the purpose. It was resolved that the following gentlemen be asked to form a sub-Committee to inquire fully into the matter, and prepare a report :—Prof. Herdman, Dr. Forbes, Messrs. A. L. Jones, A. A. Paton, A. S. Hannay, W. H. Picton, W. E. Willink, F. J. Leslie, and F. Radcliffe.

PRESIDENT CLEVELAND has appointed a scientific commission to investigate the condition of the fur seals in the North Pacific and Behring Sea. The members of the Commission are Mr. Jordan, of Stamford University (President), Lieutenant-Commander Moser, commanding the Fish Commission steamer *Albatross*, Dr. Stejneger and Mr. Lucas, both of the U.S. National Museum, and Mr. Townsend, Fish Commissioner.

THE recent electrical exposition in New York City proved so successful, pecuniarily as well as otherwise, that the managers have decided to establish a permanent exhibition. A revised estimate of the distances covered by the long-distance telegraphing at the exhibition on May 16, is 42,000 miles for the message to Tōkiō and back, covered in 47½ minutes, and over 15,000 miles for the double crossing of the North American continent and the Atlantic ocean, covered in four minutes.

THE Division of Forestry of the United States Department of Agriculture calculates the annual loss by fire to the forests in the States to amount to twenty-five million dollars.

AMONG the subjects of prizes for essays offered by the Royal Academy of Sciences of Denmark are :—Morphological and physiological researches on the asci of the Ascomycetes; the Danish species of Nematoids and Anguillulinæ; and the life-history of those Sphæriaceæ which are destructive to cereal crops.

IN the *Berichte* of the German Botanical Society, Herr A. Schober gives the result of some experiments on the effect of the Röntgen rays on the germination of the oat. He concludes that they differ from ordinary light rays in having no power of producing heliotropic curvatures, even in organs so sensitive to light as the axis of a growing seedling.

DR. Q. MAJORANA and Dr. A. Sella continue their researches on the effect of Röntgen rays and ultra-violet light on the discharge of electric sparks in air. In their latest communication to the Reale Accademia dei Lincei, they consider the manner in which the nature of the discharge is affected both by the action of these rays and by varying the sparking distance. Their present contribution includes a figure and description of the apparatus illustrated in their recent letter to NATURE, as well as of another arrangement by which the phenomena are well shown.

THE July number of the *Leisure Hour* is to contain a series of portraits of the Presidents of the Royal Society from its foundation, in 1662, to the present day. The portraits, thirty-four in number, occupy six pages of royal octavo, and form, so far as we know, an unique series. Of the thirty-six Presidents, two only—James West and Sir Cyril Wyche, neither of them very eminent men from a scientific point of view—are wanting. The accompanying article, on the Presidents of the Royal Society, has been been written by Mr. Herbert Rix, late Assistant Secretary to the Society.

THE earth-tremors and sounds produced by the Niagara Falls have been often referred to, in most cases probably with some exaggeration as regards their intensity. In a paper published in the *Yale Scientific Monthly* for last May, Mr. W. H. Brewer describes some careful observations made at various times during the last forty-five years. During one year spent at Lancaster, a village twenty-seven miles from the Falls, sounds, possibly due to the Falls, were heard on three occasions, but it was uncertain whether they might not have come from Buffalo, which is hardly ten miles distant. The tremor observations were made within a few miles of the Falls, and show that the vibrations are extremely irregular, varying both in amplitude and period. Sometimes they stop for an instant, then steadily increase in intensity, reaching one or several maxima, afterwards steadily declining. The momentary pauses do not, however, recur at regular intervals.

THE *Board of Trade Journal* reports that the Pharmaceutical Society of Prague will celebrate its twenty-fifth anniversary this year by an international exhibition of pharmacy, to be held from August 15 to September 15, at Prague, and to include the following groups :—Scientific apparatus and articles used in pharmaceutical work, and the literature having reference to same; machinery and various apparatus serving for the manufacture of pharmaceutical articles, pharmacy fittings, &c.; products and drugs used in pharmacy; manuscript books, statistics, and tables concerning the historical development of pharmacy; hygiene, and the care of invalids. There has been no important exhibition of pharmacy in Europe since 1883, and the forthcoming one at Prague this year is to include all features of progress in the pharmaceutical branch and its ramifications. Meetings of various pharmaceutical societies will be held at Prague during the exhibition. Particulars may be obtained from Dr. Charles Fragner, Pharmacien, Président du Comité Exécutif, à Prague.

IN connection with the cloud observations to be made during the international cloud year commencing May 1, *Science* of May 29 has some interesting notes by Mr. R. De C. Ward, of the Harvard University, on scientific kite-flying under the superintendence of the Washington Weather Bureau, and the Blue Hill Observatory. Instead of being flat and tapering at the lower end, the kites used are box-shaped, with their ends open and their sides partly covered with cloth or silk, and when fine piano wire is used, instead of twine, they are found to be splendid flyers. Recent ascents have reached altitudes of nearly a mile above sea-level, and excellent results have been obtained by means of a self-recording instrument made by Mr. Fergusson, of the Blue Hill Observatory, which gives automatic readings of temperature, pressure, humidity, and wind velocity. Among the most important matters that have hitherto been noted is the presence of cold waves and warm waves at considerable elevations some hours before the temperature changes are noted at the earth's surface. The prospect of improving weather forecasts by such means and by the use of small pilot balloons, which can be made at slight expense, and can reach considerable altitudes, is considered to be very encouraging.

IN a paper in the *Photographische Mitteilungen*, Jahrgang 33, Hefte 1 and 2, entitled "Über chromatische Homofocallinsen und über meine chromatische Planparallelplatte," Dr. Hugo Schroeder gives an account of the uses that may be made of a compound lens of which the external surfaces are plane and parallel, while the component lenses join internally at surfaces of any convenient curvature. The simplest form of a double lens of this kind may be derived from an ordinary plano-convex achromatic objective by grinding the front (convex) surface of the crown lens to a plane. Such a lens would evidently have almost exactly the same chromatic and spherical aberrations as the removed plano-convex portion, but with the opposite signs. By substituting crown glass for flint, and *vice versa*, the character of the lens may be reversed. Inserted in the cone of rays coming from an achromatic object-glass, a suitable plane lens of this kind shows what would be the effect of altering the curvatures of the surfaces of the object-glass. For this kind of lens Dr. Schroeder proposes the name of "Corrector." Again, by the use of such a corrector an ordinary achromatic telescope may be fitted for photographic work, and this can be done without greatly changing the place of the focal plane. By moving the corrector along the axis, different groups of rays may be brought together to suit the photographic method employed. As independently pointed out by Prof. Keeler and Mr. Newall, one difficulty, however, cannot be overcome: the available field of view will always be very restricted; unless, indeed, the correcting lens is made so large as to become practically an extra member of the object-glass.

FROM an artesian well, 188 feet deep, recently bored at San Marcos, Texas, there were expelled more than a dozen specimens of a remarkable batrachian, together with numerous crustaceans. The latter are described by Mr. Benedict, and the batrachian by Dr. Stejneger (*Proc. U. S. Natl. Mus.*, vol. xvii., 1896). From the *American Naturalist*, it appears that the crustaceans comprise numerous shrimps (one new species, *Palæmonetes antrorum*), a lesser number of Isopods of a new genus (Cirolanides), and a very few Amphipods. All the species are white, blind, and have unusually long, slender feet and antennæ. The batrachian, for which Stejneger creates a new genus, is described under the name *Typhlomolge rathbuni*. It belongs to the family Proteidæ, and is more nearly allied to Necturus than to Proteus. Like the crustaceans, it is blind. The most remarkable external feature is the length and slenderness of the legs. In commenting on this peculiarity, Dr. Stejneger says: "Viewed in connection with the well-developed finned swimming tail, it can be safely assumed that these extraordinarily slender and elongated legs are not used for locomotion, and the conviction is irresistible that in the inky darkness of the subterranean waters they serve as feelers, their development being thus parallel to the excessive elongation of the antennæ of the crustaceans." The gills are external, its colour nearly white, having the upper surfaces densely sprinkled with minute pale grey dots, and its total length measures 102 mm.

YET another method or the separate identification of the colon from the typhoid bacillus has been furnished to the bewildered bacteriologist by Dr. Piorkowski from Berlin. Recognising the fact, now established by so many investigators, that both the colon and typhoid bacillus are frequently found in urine, and that the former is regarded as undoubtedly intimately associated with various processes of inflammation, Dr. Piorkowski has compared the growth of these two micro-organisms in broth, gelatine, and agar, to which he made additions of urine. He states that whereas the typhoid-bacillus cultures, both in colonies and tubes, exhibited fine hairy extensions resembling in the case of the colonies the well-known medusa-head-like appearance so characteristic of the anthrax bacillus, the colon bacillus never forsook its compact form of growth, and only occasionally were very small, short hairy extensions visible in the contour of the colonies. We agree with Dr. Piorkowski that his method of diagnosis is easily applied, but we are not altogether convinced as to its efficacy. Colonies of the colon bacillus may also exhibit very characteristic whip-like extensions under circumstances which at present we are not in a position to exactly determine, but these so-called abnormal colonies were obtained from colon bacilli derived from a sample of cystitis-urine. Already the catalogue of comparative tests is considerable through which typhoid and colon bacilli are required to be passed, and unless a decided advance can be recorded on these, we think it is unnecessary that the bacteriologist should add to his burdens by adopting any more.

THE artesian water question continues to largely occupy the attention of Australian geologists and engineers. We have received an abstract of Mr. J. P. Thomson's presidential address to the Royal Geographical Society of Australasia, on the alleged leakage of artesian water. The address seems to have been called for by the too ready acceptance by local writers of Mr. R. L. Jack's tentative suggestion that the artesian water of the porous Lower Cretaceous beds might largely leak away to the sea. Mr. Thomson considers there is no evidence of such leakage: it is true that at various places off the coast fresh water is known to rise through the sea-water from below, but there is no evidence to associate such submarine springs with Lower Cretaceous outcrops—the water may more probably be derived from the Tertiary beds which form the actual coast. On the other hand, the geological structure of the continent seems to prevent the possibility of an unbroken flow of water to a submarine outcrop, if such outcrop exists. Referring to the asserted great excess of the rainfall over the river-flow, which had been put forward as evidence of the artesian leakage, he points out on the one hand the enormous evaporation in such a climate as that of Central Australia (quoting some striking instances of this), and on the other hand, that there has hitherto been no systematic gauging of the flow of the Australian rivers.

Prof. J. S. Bassett, in his "Slavery and Servitude in the Colony of North Carolina" (*Johns Hopkins Univ. Studies in Hist. and Polit. Sci. Studies*, 14th ser., iv.-v.), has recently published a valuable study on the history and sociology of slavery in North Carolina. In the West Indies the Spaniards early destroyed the native population, and so they imported the negro, and established colonies of slaves, driving them to the fields and back to the barracks, and treating them much as the Romans did their slaves. The ideal of the Virginian planter was that of an English county gentleman: he wanted to group his slaves around him, and deal personally with them. There were, however, two main obstacles: (1) the Indians must be either exterminated or driven into the interior, for fear of massacres; (2) the white population must become dense enough to resist any insurrection among the negroes, hence large numbers were not introduced at first. About 1712, these obstacles were practically removed. The first slaves in America were Indians; but as they were fierce and caused trouble, they were never very numerous. The first labourers the English took to the New World colonies were whites; these consisted of indented servants, transported felons, and kidnapped persons, usually children. From 1661-1671 the conscience of the English public was awakened, so that only properly registered emigrant servants could be taken across the Atlantic; besides, negro slaves were found to be cheaper than white servants. It was the survival of the fittest. Both Indian slavery and white servitude were to go down before the black man's superior endurance, docility, and labour capacity.

Dr. Bassett's account of the social conditions of the natives is also interesting; nor is the history of the attitude of religion to the slave question less so. At first, at all events, the planters were unwilling to allow the conversion of negroes, there being a doubt in their minds whether conversion would not enfranchise them. When the negroes happened to be professed Christians they might join any church they liked, but till 1741 they were not allowed to have a church organisation or building among themselves. With the exception of the Society of Friends, who became unanimous on this point in 1776, none of the sects opposed the ownership of slaves.

A translation of Dr. Carl Freiherr v. Tubeuf's "Diseases of Plants due to Cryptogamic Parasites," by Dr. W. G. Smith, is about to be published by Messrs. Longmans.

Dr. J. Doerfler, of Vienna, has published his *Botaniker Adressbuch*, a guide to botanists throughout the world. It contains upwards of 6000 addresses of botanists, as well as those of botanical gardens, botanical institutes, societies, and journals.

We have received vol. iii., No. 4, of the "Bulletin from the Laboratories of Natural History of the State University of Iowa," containing several papers on the fauna and flora of Iowa, as well as of Mexico, Arizona, and Nicaragua. The *Botanical Gazette* has long been urging American naturalists to compile their local faunæ and floræ on some more satisfactory lines than the often very arbitrary division-lines between the States.

M. J. Daveau describes, in the *Journal de Botanique*, a remarkable example of proterandry extending over a whole season, in the case of a palm (species not given) belonging to the genus *Kentia* (*Howea*) grown in the open air in the Botanic Garden at Lisbon. The flowers are grouped together in clusters within the spathe, each cluster consisting of three flowers, two male and one female. The female flower in each cluster is only in a very rudimentary condition, even after the male flowers have shed their pollen and dropped; they remain in this condition through the autumn and winter, and expand only at the same period in the next summer, when the male flowers in other newly-formed inflorescences are discharging their pollen.

Scientific book-hunters will be glad to have their attention called to two lists just issued. One comes from Messrs. Macmillan and Bowes, Cambridge, and contains the titles of more than seventeen hundred books and papers on pure and applied mathematics, astronomy, meteorology, chemistry, and other branches of physical science, from the libraries of the late Prof. Henry Smith and Mr. Cowper Ranyard; the other contains the titles of 341 works on branches of natural science, offered for sale by Messrs. Williams and Norgate.

Messrs. J. B. Lippincott Co. have published a second edition of "A Manual of North American Birds" by Mr. Robert Ridgway. The work now runs into 653 pages, and is illustrated by 464 outline drawings of the generic characters. The knowledge of North American birds gained since the publication of the work in 1887, has been fully utilised in the preparation of the new edition; and the new species and sub-species added since that date are given in an appendix. Ornithologists, and particularly those in the United States, will be glad to have this carefully revised edition of a valuable manual.

Observations of local meteorology carried on in a systematic way, as they are in the Observatory of the Southport Town Council, furnish data of more than local value. The report of Mr. Joseph Baxendell, Meteorologist to the Corporation, upon the results of observations made in 1895 at places within and around the borough of Southport, has just been received, and it testifies to a large amount of careful work. In the course of his introductory remarks, Mr. Baxendell refers to "the serious differences between the indications of the Campbell-Stokes Standard and the Jordan Photographic Sunshine Recorders." It is hardly satisfactory that the duration of sunshine should be recorded so differently by the two classes of instruments.

The Royal Cornwall Polytechnic Society has published its sixty-third annual report, being for the year 1895. For many years the Falmouth Observatory, in connection with that Society, has been one of the principal stations of the Meteorological Council, and in addition to the records of the photographic and other self-recording instruments required by that body, it publishes results of magnetic and sea temperature observations. During the year in question, Prof. Rücker spent some time at the observatory for the purpose of comparing the magnetic instruments with those at Kew, and his report bears testimony to the skill and accuracy of the observer, and to the thoroughness of the work done. The Society holds an annual exhibition, when any special features are introduced by which industry may be encouraged, and visitors interested and instructed. The report contains accounts of interesting lectures on the old Falmouth Packet Service, by Mr A. H. Norway, and on some senses in fishes, by Mr. M. Dunn

Under the title "Lloyd's Natural History," Messrs. Edward Lloyd (Limited) is issuing in parts the works which Messrs. W. H. Allen and Co. have for the past two or three years been publishing as "Allen's Naturalist's Library," and which is itself a revised and enlarged edition of "Jardine's Naturalist's Library." The first part of this *réchauffé* series has just been received, and we may be pardoned a little surprise at finding that no reference is made in it to the original edition, so that to the general public "Lloyd's Natural History" appears as a new work. The present part comprises 112 pages and eleven coloured plates, and is a section of one of the volumes on "British Birds" contributed by Dr. Bowdler Sharpe to "Allen's Naturalist's Library." We are glad to see the issue of this series in parts, notwithstanding the information withheld as to the origin of it. In spite of the many unsatisfactory figures, the work is sound and methodical, and its serial publication will undoubtedly increase the number of students of natural history.

SEVERAL parts of the very fine "Illustrations of the Zoology of H.M. Indian Marine Surveying Steamer *Investigator*," under the Commander, A. Carpenter, the late Commander, R. F. Hoskyn, and Commander C. F. Oldham, have lately been received. The plates are splendid examples of photo-etchings, and they will be treasured by marine zoologists. Fishes are represented upon sixteen plates, Crustacea upon fifteen plates, and Echinoderma upon five plates. The illustrations are only accompanied by brief explanations, the descriptions of the various species having appeared in the *Annals and Magazine of Natural History*, and in the *Journal of the Asiatic Society of Bengal*. Mr. A. Alcock is responsible for the fishes described and figured, and, in conjunction with Mr. A. R. S. Anderson, for the Echinoderma. The Crustacea have been mostly done under the direction of the late Mr. J. Wood-Mason.

NEARLY a year ago (NATURE, vol. lii. p. 290), the second volume of the second edition of Dr. George Lunge's treatise on "The Manufacture of Sulphuric Acid and Alkali" (Gurney and Jackson) was reviewed in these columns, and the value of the work to investigators and industrial chemists as a standard work of reference on alkali manufacture was pointed out. The third volume, completing the second edition of the book, has now been published, and the words of praise applied to the second volume are just as fully deserved by the present one. The amplification of the original text has been so considerable, and the revision so thorough, that the work has grown beyond recognition. Only a few chapters resemble those of the first edition, and the chapters on ammonia-soda, on the more recent soda-process, on the Deacon process, and the other chlorine processes, have been entirely rewritten; while a section on the preparation of alkalis, chlorine, and chlorates by electrolysis, appears for the first time. The second edition of the complete work is half as large again as the first; it is well up to date, and forms a most serviceable survey and digest of the whole ground of alkali manufacture.

THE meteorological and magnetic observatory of the University of Odessa has for its functions not only the reading of the numerous instruments with which it is equipped, and the discussion of the results observed and registered, but it is intended also to serve as a high school where students of the faculty of physics and mathematics can be trained in the work of meteorology and physical geography. In order to give more importance to this course, Prof. Klossovsky has drawn up a syllabus, which is printed in the 1895 volume of the "Annales" of the Observatory at Odessa. The course is divided into three parts, the first two of which are devoted to fundamental observations, to the installation and study of instruments used in meteorology and terrestrial physics, and to the determination of various elements. The third course is intended for those who propose to take up physical geography or meteorology as a special subject. The programme is an admirable outline of the work of meteorology and terrestrial physics, and but for limit of space we would give a full translation of it. Schools in meteorology are so few, that the development of the curriculum of the Imperial University at Odessa will be welcomed by all who think that trained investigators and experimental work are needed for the advancement of the science.

THE additions to the Zoological Society's Gardens during the past week include a Hoolock Gibbon (*Hylobates hoolock*, ♀) from Assam, presented by Mrs. Firman; two Fat Dormice (*Myoxus glis*) from Austria, presented by Mr. John G. Haggard; a Short-toed Eagle (*Circætus gallicus*) from Egypt, presented by Dixon Bey; a Vulturine Eagle (*Aquila verreauxi*) from South Africa, presented by Mr. J. Clark; two Short-eared Owls (*Asio brachyotus*) from Ireland, presented by Captain R. A. Ogilby; five Cormorants (*Phalacrocorax carbo*) from the Isle of Mull, presented by Maclaine of Lochbuie; three Dwarf Chameleons (*Chamæleon pumilus*) from South Africa, presented by Miss Jessie M. Hudson; eight Natterjack Toads (*Bufo calamita*), two Common Toads (*Bufo vulgaris*), British, presented by Mr. Stanley S. Flower; two Axolotls (*Siredon mexicanus*) from Mexico, presented by Mr. W. Temple; nine Green Turtles (*Chelone viridis*) from Ascension, presented by Mr. J. C. Adlam; a Hoolock Gibbon (*Hylobates hoolock*, ♀) from Assam, an Indian Chevrotain (*Tragulus meminna*), two Indian Drongos (*Chibia hottentota*), two Tigers (*Felis tigris*, ♂ ♀) from India, a Javan Chevrotain (*Tragulus javanica*) from Java, a Harnessed Antelope (*Tragelaphus scriptus*, ♂) from West Africa, deposited.

OUR ASTRONOMICAL COLUMN.

PHOTOGRAPHS OF STELLAR SPECTRA.—Dr. F. McClean is now engaged on a photographic investigation of the spectra of the northern stars down to the third magnitude. About 160 stars will thus be included in the survey. Some of the results, which have been recently communicated to the Royal Astronomical Society, comprise the spectra of twenty-three characteristic helium stars, and photographs of the spectra of six stars of the third magnitude showing the transitions from one type to another (*Monthly Notices*, vol. lvi. p. 428). The instrument used is a photographic telescope of 12 inches aperture and 11 feet 3 inches focal length, having an objective prism of the same aperture placed in front of the object-glass. The refracting angle of the prism is 20°. The prism is mounted on a hinged frame, and the cell containing it can be rotated within the frame, so that all necessary adjustments can be effected with facility.

THE NATAL OBSERVATORY.—Two reports which have recently been received from Mr. Nevill, the Superintendent of the Natal Observatory, indicate considerable astronomical activity at this southern station. "The principal series of observations in progress is the comparison of the declination deduced from observations made at the observatories in the northern and southern hemispheres by a comparison by Talcott's method of the zenith distance of northern zenith stars and southern circumpolar stars at upper and lower culminations." Over a hundred pairs of stars are under observation. The publication of the Greenwich observations of Mars during the opposition of 1892 renders it possible to utilise the corresponding Natal observations for the determination of a new value of the solar parallax, and this work will be undertaken. During the opposition of Mars in 1894 the weather proved very unfavourable, and no observations of value were secured. A great mass of important work done at the observatory awaits facilities for publication. The entire staff amounts to only four observers and computers, and the instrumental equipment is equally small. The system of time signals and meteorological work were carried on as in former years.

POSSIBLE CHANGES IN THE EARTH'S ROTATION.—As the result of a recent investigation (*Comptes rendus*, June 1), Prof. Newcomb makes the startling suggestion that the earth's rotation is not perfectly uniform. The discussion was undertaken in connection with the long-period inequalities in the moon's mean motion, which so far have not been satisfactorily explained. The possibility of a variation in the earth's rotation period being admitted, and consequently of an error in our mode of reckoning time, it becomes necessary to employ some method of measuring time which shall be independent of the earth's rotation. This appears to be best furnished by observations of the transit of Mercury. Prof. Newcomb has accordingly discussed all the November transits since 1677, and has compared the observed times of ingress and egress with those computed on the basis of his new tables for the sun and Mercury. Although in many cases the residuals may not be greater than the probable errors, there is a significant systematic character about them, as shown when the observations are grouped as follows:—

Transits.	Residuals. s. s.
1677—1769	−5·4 ± 2·5
1789—1861	+6·4 ± 1·5
1868	−1·5 ± 3·5
1881—1894	−3·1 ± 1·6

It is concluded that "the observations of transits of Mercury clearly indicate small variations in the rotation of the earth, of